

1. A process for producing an aluminum alloy sheet product having a controlled recrystallization using a continuous caster to cast a molten aluminum alloy into a slab comprising:

- (a) providing a source of molten aluminum alloy;
- (b) providing a caster for continuously casting said molten aluminum alloy into a slab;
- (c) rolling said slab into a sheet product;
- (d) continuously annealing said sheet product at a temperature in a controlled temperature range;
- (e) measuring degree of recrystallization of said sheet product on a continuous basis to provide a recrystallization related signal;
- (f) relaying said signal to a controller;
- (g) in said controller, comparing said signal to previous signals relating degree of recrystallization of said sheet product to provide a comparison; and
- (h) in response to said comparison, maintaining or changing said temperature in said temperature range upwardly or downwardly to produce aluminum sheet product having desired recrystallization.

2. The process in accordance with claim 1 wherein said rolling is hot rolling to produce a hot rolled strip.
3. The process in accordance with claim 1 wherein said rolling includes hot rolling said slab having a hot mill entry temperature in the range of 700° to 1100°F.
4. The process in accordance with claim 1 including employing a twin belt caster to produce a slab 0.2 to 2 inches thick.
5. The process in accordance with claim 2 including heating said slab prior to said hot rolling.
6. The process in accordance with claim 1 including hot rolling said slab to a thickness in the range of 0.01 to 0.25 inch.
7. The process in accordance with claim 1 including heating said slab to a temperature in the range of 800° to 1100°F prior to said rolling.
8. The process in accordance with claim 2 including cold rolling said hot rolled strip to produce a cold rolled sheet.

9. The process in accordance with claim 8 including annealing said cold rolled sheet.

10. The process in accordance with claim 1 including casting a molten aluminum alloy selected from the group consisting of AA1XXX, AA3XXX, AA5XXX and AA6XXX alloys.

11. The process in accordance with claim 1 including casting a molten aluminum alloy selected from the group consisting of AA3004, AA5052, AA5182, and AA5754 alloys.

12. The process in accordance with claim 2 including cold rolling said hot rolled strip to a final gauge after said annealing step.

13. The process in accordance with claim 2 including cold rolling said hot rolled strip to a gauge in the range of 0.01 to 0.16 inch.

14. A process for producing an aluminum alloy sheet product having a controlled recrystallization using a twin belt caster to cast a molten aluminum alloy into a slab comprising:

- (a) providing a source of molten aluminum alloy;
- (b) providing a twin belt caster for continuously casting said molten aluminum alloy into a slab;
- (c) hot rolling said slab into a hot rolled sheet product;
- (d) continuously annealing said sheet product at an anneal temperature in a controlled temperature range to provide recrystallization of said hot rolled sheet product;
- (e) monitoring said anneal temperature;
- (f) measuring degree and type of recrystallization of said sheet product on a continuous basis to provide a recrystallization related signal;
- (g) relaying said signal to a controller;
- (h) in said controller, comparing said signal to previous signals relating to degree and type of recrystallization of said sheet product to provide a comparison; and
- (i) in response to said comparison, maintaining said anneal temperature or changing said anneal temperature upwardly or downwardly to produce aluminum alloy sheet product having desired recrystallization for high levels of formability.

15. The process in accordance with claim 14 including hot rolling said slab having a hot mill entry temperature in the range of 700° to 1100°F.

16. The process in accordance with claim 14 wherein said slab is 0.2 to 2 inches thick.

17. The process in accordance with claim 14 including heating said slab prior to said hot rolling.

18. The process in accordance with claim 14 including hot rolling said slab to a thickness in the range of 0.01 to 0.25 inch.

19. The process in accordance with claim 14 including heating said slab to a temperature of 800° to 1100°F prior to hot rolling.

20. The process in accordance with claim 14 including cold rolling said hot rolled sheet product after annealing.

21. The process in accordance with claim 14 including cold rolling to final gauge said hot rolled sheet product after annealing.

22. The process in accordance with claim 14 including cold rolling said hot rolled sheet product to a gauge in the range of 0.01 to 0.16 inch.

23. The process in accordance with claim 14 wherein said aluminum alloy is an alloy selected from the group consisting of AA1XXX, AA3XXX, AA5XXX and AA6XXX aluminum alloys.

24. The process in accordance with claim 14 wherein said aluminum alloy is AA3004.

25. The process in accordance with claim 14 wherein said aluminum alloys are AA5052, AA5754 and AA5182.

26. A control method for continuously producing highly recrystallized, aluminum alloy sheet product having high levels of formability using a twin belt caster to cast a molten aluminum alloy into a slab comprising:

- (a) providing a molten aluminum alloy selected from the group consisting of AA1XXX, AA3XXX, AA5XXX, and AA6XXX alloys;
- (b) continuously casting the molten aluminum alloy into a slab;
- (c) hot rolling said slab into a flat product at a hot rolling starting temperature in the range of 700° to 1100°F;

(d) continuously annealing said flat product at an anneal temperature in a temperature range of 600° to 1100°F to effect recrystallization of the flat product;

(e) monitoring at least one of said hot rolling starting temperature and annealing temperature;

(f) measuring degree of recrystallization of said flat product after annealing on a continuous basis to provide a recrystallization related signal;

(g) relaying said signal to a controller;

(h) in said controller comparing said signal to previous signals relating degree of recrystallization of said flat product to provide a comparison; and

(i) in response to said comparison maintaining or changing at least one of said starting temperature and said anneal temperature upwardly or downwardly sufficient to produce aluminum alloy sheet having the recrystallization necessary to provide high levels of formability and desired earing.

27. The method in accordance with claim 26 including heating said slab prior to hot rolling.

28. The method in accordance with claim 26 including hot rolling said slab to a flat product having a thickness in the range of 0.01 to 0.25 inch.

29. The method in accordance with claim 26 including cold rolling said flat product after annealing.

30. The method in accordance with claim 26 including cold rolling said flat product after annealing to a gauge in the range of 0.01 to 0.16 inch.

31. The method in accordance with claim 26 wherein said alloy is AA3004.

32. The method in accordance with claim 26 wherein said alloy are AA5052, AA5754 and AA5182.

33. The method in accordance with claim 26 including maintaining or changing said starting temperature upwardly or downwardly to produce said sheet.

34. The method in accordance with claim 26 including maintaining or changing said anneal temperature upwardly or downwardly to produce said sheet.



35. A control method for producing recrystallized aluminum alloy sheet product using a continuous caster to cast a molten aluminum alloy comprising:

- (a) providing a source of molten aluminum alloy;
- (b) continuously casting said molten aluminum alloy into a slab;
- (c) hot rolling said slab into a flat rolled product in a temperature range;
- (d) continuously annealing said flat rolled product at a temperature in the range of 600° to 1100°F to provide a recrystallized, annealed, flat rolled product;
- (e) measuring recrystallization of said annealed flat rolled product to provide a recrystallization related signal;
- (f) relaying said signal to a controller;
- (g) in said controller comparing said signal to signals relating degree of recrystallization of said annealed, flat rolled product to provide a comparison; and
- (h) in response to said comparison maintaining temperature of one of said slab or increasing or decreasing temperature of said slab to produce a flat rolled product having a recrystallized structure.

36. The method in accordance with claim 35 including hot rolling said slab starting at a temperature in the range of 700° to 1100°F.

37. The process in accordance with claim 35 including employing a twin belt caster to produce a slab 0.2 to 2 inches thick.

38. The process in accordance with claim 35 including heating said slab prior to said hot rolling.

39. The process in accordance with claim 35 including hot rolling said slab to a thickness in the range of 0.01 to 0.25 inch.

40. The process in accordance with claim 35 including heating said slab to a temperature in the range of 800° to 1100°F prior to said rolling.

41. The method in accordance with claim 35 including cold rolling said annealed, flat rolled product to produce a cold rolled sheet product.

42. The method in accordance with claim 35 including cold rolling said annealed, flat rolled product to a thickness of 0.01 to 0.16 inch.

43. The process in accordance with claim 35 including casting a molten aluminum alloy selected from the group consisting of AA1XXX, AA3XXX, AA5XXX and AA6XXX alloys.

44. The method in accordance with claim 35 wherein said aluminum alloy is AA3004.

45. The method in accordance with claim 35 wherein said aluminum alloy are AA5052, AA5754 and AA5182.

46. A process for producing an aluminum alloy sheet product having a controlled recrystallization using a twin belt caster to cast a molten aluminum alloy into a slab comprising:

- (a) providing a source of molten aluminum alloy;
- (b) providing a twin belt caster for continuously casting said molten aluminum alloy into a slab;
- (c) hot rolling said slab into a hot rolled sheet product at a temperature in a hot rolling temperature range;
- (d) monitoring hot rolling temperature;
- (e) measuring degree and type of recrystallization of said sheet product on a continuous basis to provide a recrystallization related signal;

(f) relaying said signal to a controller;

(g) in said controller, comparing said signal to previous signals relating to degree and type of recrystallization of said sheet product to provide a comparison; and

(h) in response to said comparison, maintaining said hot rolling temperature or changing said hot rolling temperature upwardly or downwardly to produce aluminum alloy sheet product having desired recrystallization for high levels of formability.

47. The method in accordance with claim 46 including measuring grain structure and texture of finished sheet.

48. A control method for continuously producing highly recrystallized, aluminum alloy sheet product having high levels of formability using a twin belt caster to cast a molten aluminum alloy into a slab comprising:

- (a) providing a molten aluminum alloy selected from the group consisting of AA1XXX, AA3XXX, AA5XXX and AA6XXX alloys;
- (b) continuously casting the molten aluminum alloy into a slab;
- (c) hot rolling said slab into a flat product at a hot rolling starting temperature in the range of 700° to 1100°F;
- (d) monitoring said hot rolling starting temperature;
- (e) measuring degree and type of recrystallization of said flat product after hot rolling on a continuous basis to provide a recrystallization related signal;
- (f) relaying said signal to a controller;
- (g) in said controller comparing said signal to previous signals relating degree and type of recrystallization of said flat product to provide a comparison; and
- (h) in response to said comparison, maintaining or changing said starting temperature upwardly or downwardly sufficient to produce aluminum alloy sheet having the recrystallization necessary to provide high levels of formability and desired earing.

49. A control method for producing recrystallized aluminum alloy flat rolled product using a continuous caster to cast a molten aluminum alloy comprising:

- (a) providing a source of molten aluminum alloy;
- (b) continuously casting said molten aluminum alloy into a slab;
- (c) hot rolling said slab into a flat rolled product in a temperature range to produce a flat rolled product;
- (d) measuring recrystallization of said flat rolled product to provide a recrystallization related signal;
- (e) relaying said signal to a controller;
- (f) in said controller comparing said signal to signals relating degree and type of recrystallization of said flat rolled product to provide a comparison; and
- (g) in response to said comparison maintaining temperature of said slab or increasing or decreasing temperature of said slab to produce a flat rolled product having a recrystallized structure.

50. The method in accordance with claim 49 including measuring grain structure and texture of finished sheet.

51. The method in accordance with claim 49 including hot rolling said slab starting at a temperature in the range of 700° to 1100°F.

52. The process in accordance with claim 49 including employing a twin belt caster to produce a slab 0.2 to 2 inches thick.

53. The process in accordance with claim 49 including heating said slab prior to said hot rolling.

54. The process in accordance with claim 49 including hot rolling said slab to a thickness in the range of 0.01 to 0.25 inch.

55. The process in accordance with claim 49 including heating said slab to a temperature in the range of 800° to 1100°F prior to said rolling.

56. The method in accordance with claim 49 including cold rolling said flat rolled product to produce a cold rolled sheet product.

57. The method in accordance with claim 49 including cold rolling said flat rolled product to a thickness of 0.01 to 0.160 inch.

58. The process in accordance with claim 48 including casting a molten aluminum alloy selected from the group consisting of AA1XXX, AA3XXX, AA5XXX and AA6XXX alloys.

59. A process for producing an aluminum alloy sheet product having a controlled grain structure and texture using a continuous caster to cast a molten aluminum alloy into a slab comprising:

- (a) providing a source of molten aluminum alloy;
- (b) providing a caster for continuously casting said molten aluminum alloy into a slab;
- (c) rolling said slab into a sheet product;
- (d) continuously annealing said sheet product at a temperature in a controlled temperature range;
- (e) measuring grain structure and texture of said sheet product on a continuous basis to provide a grain structure and texture related signal;
- (f) relaying said signal to a controller;
- (g) in said controller, comparing said signal to previous signals relating grain structure and texture of said sheet product to provide a comparison; and
- (h) in response to said comparison, maintaining or changing said temperature in said temperature range upwardly or downwardly to produce aluminum sheet product having desired grain structure and texture.



60. A process for producing an aluminum alloy sheet product having a controlled grain structure and texture using a twin belt caster to cast a molten aluminum alloy into a slab comprising:

- (a) providing a source of molten aluminum alloy;
- (b) providing a twin belt caster for continuously casting said molten aluminum alloy into a slab;
- (c) hot rolling said slab into a hot rolled sheet product;
- (d) continuously annealing said sheet product at an anneal temperature in a controlled temperature range to provide grain structure and texture of said hot rolled sheet product;
- (e) monitoring said anneal temperature;
- (f) measuring grain structure and texture of said sheet product on a continuous basis to provide a grain structure and texture related signal;
- (g) relaying said signal to a controller;
- (h) in said controller, comparing said signal to previous signals relating to grain structure and texture of said sheet product to provide a comparison; and
- (i) in response to said comparison, maintaining said anneal temperature or changing said anneal temperature upwardly or downwardly to produce aluminum alloy sheet product having desired grain structure and texture for high levels of formability.

61. A control method for continuously producing highly recrystallized, aluminum alloy sheet product having high levels of formability using a twin belt caster to cast a molten aluminum alloy into a slab comprising:

- (a) providing a molten aluminum alloy selected from the group consisting of AA1XXX, AA3XXX, AA5XXX and AA6XXX alloys;
- (b) continuously casting the molten aluminum alloy into a slab;
- (c) hot rolling said slab into a flat product at a hot rolling starting temperature in the range of 700° to 1100°F;
- (d) continuously annealing said flat product at an anneal temperature in a temperature range of 600° to 1100°F to effect grain structure and texture of the flat product;
- (e) monitoring at least one of said hot rolling starting temperature and annealing temperature;
- (f) measuring grain structure and texture of said flat product after annealing on a continuous basis to provide a grain structure and texture related signal;
- (g) relaying said signal to a controller;
- (h) in said controller comparing said signal to previous signals relating grain structure and texture of said flat product to provide a comparison; and

(i) in response to said comparison maintaining or changing at least one of said starting temperature and said anneal temperature upwardly or downwardly sufficient to produce aluminum alloy sheet having the grain structure and texture necessary to provide high levels of formability and desired earing.

62. A control method for producing recrystallized aluminum alloy sheet product using a continuous caster to cast a molten aluminum alloy comprising:

- (a) providing a source of molten aluminum alloy;
- (b) continuously casting said molten aluminum alloy into a slab;
- (c) hot rolling said slab into a flat rolled product in a temperature range;
- (d) continuously annealing said flat rolled product at a temperature in the range of 600° to 1100°F to provide a recrystallized, annealed, flat rolled product;
- (e) measuring grain structure and texture of said annealed flat rolled product to provide a grain structure and texture related signal;
- (f) relaying said signal to a controller;
- (g) in said controller comparing said signal to signals relating grain structure and texture of said annealed, flat rolled product to provide a comparison; and
- (h) in response to said comparison maintaining temperature of one of said slab or increasing or decreasing temperature of said slab to produce a flat rolled product having a desired recrystallized structure.

63. The method in accordance with claim 62 including measuring grain structure and texture of finished sheet.